

GEOLOGY FOR AGRICULTURAL STUDENTS.

Agricultural Geology. By J. E. Marr. Pp. xi+318. (London: Methuen and Co., 1903.) Price 6s.

IN the teaching of any technical subject, like engineering or agriculture, which touches and depends upon several of the pure sciences, there has always been dispute about the amount and nature of the pure science to be exacted from the technical student, the present controversy over mathematics for engineers being a notable example. In the past, as a rule, the pure science man has ruled the roast, secure in a plausible logical position which regards the technical as "applications" of the principles laid down in the pure science, as "riders" in fact; now, however, he has, thanks to the spread of truer conceptions of education, to justify his teaching and discard those intellectual gymnastics which leave the student "as he was," and confine himself to a development of the subject to the given end.

In the book before us, Mr. Marr has put together that portion of geology with which a serious agricultural student ought to be equipped as a basis for his study of soils; more particularly the book is intended for candidates preparing for the examination for the National Diploma in Agriculture.

The earlier part of the book seems to us to be admirably suited to the agricultural student; he will get from it just the introductory knowledge of minerals and rocks, rock structures, and the work of geological agencies that he requires for an intelligent appreciation of the structure of the country. There is nothing superfluous, and, on the other hand, the proper point of view is obtained, the subject is developed as a whole, and not allowed to become a series of scraps of useful knowledge.

Two excellent chapters follow on the construction and interpretation of geological maps and sections, but we should have liked to see the later chapter on "water supply" brought into connection with this section, and treated in much more detail. To the agriculturist, structural geology is in the main important only as bearing upon water supply; it is fundamental that he should be able to read a geological map so as to gauge the probabilities of obtaining either surface or deep-seated water at a practicable depth, or to trace the origin of landsprings and decide upon a plan for tapping them or otherwise drying the land. We trust Mr. Marr will see his way in another edition to work out for the student some examples of the varying conditions of water supply, not by generalised diagrams, but from the actual survey maps.

The weakest part of the book is the last, the chapters dealing with stratigraphical geology; the economic products are but lightly touched upon, and the agricultural character of each formation is dismissed in a very sketchy and generalised fashion. If we compare the two pages or so devoted to the structure of Graptolites—the chitinous rod, the periderm, the hydrothecæ, &c.—with the amusing reference to the clay-with-flints, "Little will grow on it, though in places it has been made to yield good root crops," we see the difference between Mr. Marr the geologist, writ-

ing of what he likes and understands, and Mr. Marr "getting up" things for the agriculturist. Lastly, we should have liked a little more about the "drift" and the superficial deposits generally, for the farmer is more concerned with them than with the solid geology. In this connection we should like to know Mr. Marr's evidence for the following statement (p. 128):—

"One very important character of glacial drift from the point of view of soil formation is due to the fact that the disintegrating action of ice is purely mechanical, and, consequently, the soluble constituents of the rocks from which the drift has been derived have not been removed. These soluble constituents may be taken up by the plants but slowly, and accordingly the drift soils may not yield such abundant crops as other soils at the outset, but, on the other hand, they may continue to furnish supplies of these soluble materials long after those of other soils have been exhausted."

We are not sure we understand the meaning of this paragraph, but at any rate we demur to the apparent implication that soils become exhausted by cultivation as practised in this country.

APPLIED MECHANICS.

Elementary Applied Mechanics. By Profs. T. Alexander, C.E., and A. W. Thomson, D.Sc. Pp. xx+575; 281 illustrations. (London: Macmillan and Co., Ltd., 1903.) Price 42s.

THE title of this book is misleading. It is really a large and fairly advanced work dealing with certain engineering problems usually, now, classed under the headings "Strength of Materials" or "Theory of Structures." Simple problems in connection with stress and strain are taken up in chapter i., useful numerical examples being given by way of illustration and enforcement. Such examples, in fact, form a valuable feature of the work throughout. The authors—professors at Trinity College, Dublin, and Poona, India, respectively—dedicate the book to the memory of their late teacher, Prof. Rankine. Their study of that great authority has not, however, produced that terseness and lucidity of expression now so much prized. Thus the lengthening of a strut is called "augmentation," and shortening, we are led to infer, is "negative augmentation." Again, we read,

"The *Proof Load* is the stress of greatest intensity which will just produce a strain having the same ratio to itself which the strains bear constantly to the stresses producing them for all stresses of less intensity. If a stress be applied of very much greater intensity, the piece will break at once, &c."

One notices circumlocutions of this kind in various places.

Internal stresses and strains, simple and compound, are next taken up, and a picture of a model for illustrating Rankine's "ellipse of stress" is given and explained.

The stability of earthwork is dealt with in chapter iv.—as usual in such investigations, all depends on a knowledge of the "angle of repose," a very variable

quantity, and one not easily found practically. Chapter v. is devoted to the design of masonry retaining walls; the table of thicknesses for walls and the graphical solutions at the end of the chapter are particularly valuable. Chapter vi. commences an important section dealing with transverse stress, and relating mainly to the strength and stiffness of beams. After discussing the position of the neutral axis and the stress at a point in the section, the authors, oddly enough, give a chapter on the parabola, such as one might expect in a work on descriptive geometry. A clearly written chapter on graphical statics might have been introduced here with advantage. Diagrams of bending moment and shearing force are next discussed, and we come to the subject of continuous beams—one of increasing importance. Diagrams of shear and bending for girders with moving loads are then taken up at length, and a model is illustrated showing how the variations in these quantities, as a model loco. passes over a model bridge, may be exhibited to a class.

Combined live and dead loads are next considered, and approximations by the introduction of a so-called "equivalent live load" are dealt with at some length in chapter xiii., after which the *resistance* of a section to bending and shear is discussed, some neat graphical methods of finding the moment of inertia of, and the amount and distribution of shearing force at, a section being explained.

The very interesting use of the polariscope in investigating internal stress and strain, due to the late Prof. Peter Alexander, is fully described. Questions relating to curvature are next dealt with, the integral calculus being freely used. Amongst all the mass of weighty matter one does not find, so frequently as might be, useful practical rules and results set out clearly in heavy type. For instance, the point of, and amount of, the maximum deflection of a beam fixed at one end and supported at the other, with different distributions of loading, is often wanted in practice—we do not notice it prominently given here.

Struts, various kinds of trusses, linear arch ribs, &c., are taken up, analytical methods having the prominence rather than graphic methods, though the latter are employed to a very limited extent.

Tables relating to the "two-nosed catenary," the design of segmental arches, and other like matters bring this not at all elementary, yet valuable, work to a close except for an appendix, in which graphic methods are applied to a roof truss—evidently as an afterthought.

R. G. B.

OUR BOOK SHELF.

The Principles of Animal Nutrition, with Special Reference to the Nutrition of Farm Animals. By Henry Prentiss Armsby, Ph.D., Director of the Pennsylvania State College Agricultural Experiment Station. Pp. vii+614. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1903.) Price 17s.

THE growth of institutions similar to that with which the classical labours of Lawes and Gilbert in this country are associated has been nowhere more marked than in the United States of America. The natural

advantages of unlimited territory and virgin soil have no doubt much to do with the position of agricultural industry in that country, but added to this has been the recognition by the American people that farming, to be a success, must be conducted on scientific principles. Our Canadian cousins cannot be said to be behind their neighbours in this respect. The numerous and valuable memoirs which are being constantly issued from these agricultural experiment stations speak much for the industry and acumen of those engaged in conducting and superintending research there.

Dr. Armsby's book is a very successful attempt to present the present results of such work, so far as it relates to nutrition, in a systematic manner. It is, however, not a mere handbook for the stock raiser, but will amply repay careful perusal by students of physiology. It is a veritable mine of valuable statistics, and nowhere do we remember to have seen more clearly stated the great problems of metabolism and the methods by which they have been, and may be, solved. The law of the conservation of energy is as true for the chemistry of the living organism as it is for that of the laboratory, and it has been Rubner's epoch-making work to demonstrate that this can be experimentally verified. Much in the present book is naturally taken from Rubner; other names prominently quoted are those of Zuntz and Atwater. References are given to all important papers cited, and this materially enhances the value of Dr. Armsby's book. Where so much is excellent, it seems rather like carping criticism to point to minor deficiencies. We cannot, however, help noticing that the author's views on the digestion of proteids taken from a book published nearly ten years ago are somewhat antiquated; Kühne's theory on the hemi- and anti-products of gastric proteolysis has now been abandoned. The statement, also, that the fat of the food is absorbed largely in the form of an emulsion requires revision. In connection with the question of uric acid formation, Dr. Armsby does not appear to have grasped the now well-established fact that the formation of this substance in the bird is mainly synthetic, while in the mammal it is mainly, if not entirely, oxidative; he need not, therefore, hesitate to accept the view of its origin from nuclein and purin in these animals.

We, however, congratulate the author most sincerely on the book as a whole. So many books that one comes across nowadays are repetitions or imitations of others that it is refreshing to come across one which forms a material addition to knowledge.

Chemical Technology. Vol. iv. Electric Lighting.

By A. G. Cooke, M.A., A.M.I.E.E., and Photometry, by W. J. Dibdin, F.I.C., F.C.S. Pp. xviii+378. (London: J. and A. Churchill, 1903.) Price 20s.

ONE must not expect too much of a book which aims at treating, in less than 300 pages, the whole subject of electric lighting, from the generation of electric energy in the central station to the manufacture of the lamp for its consumption in the user's house. As a work of reference for technical men engaged in other branches of work, but coming occasionally into contact with electrical engineering, this book should prove useful, just as an article in an encyclopædia is useful. And just in the same way as an encyclopædia article is defective, it seems to us that the book before us fails; by endeavouring to give too much information it only succeeds in giving too little. These objections apply rather to the scheme of the work than to the way in which Mr. Cooke has carried it out, which is as satisfactory as possible in the circumstances. In some instances the book is very much up-to-date; thus, it is probably one of the first text-books containing a good description of the Nernst lamp, though it is to be